The ncolumn package

N columns in the way of `\twocolumn`, with material that spans columns

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1 Introduction

multicol collects the material of all columns and splits it into the columns afterwards. Ordinary floats cannot be used in it, and packages that look at the room that is left on the page, such as tcolorbox with `breakable`, need extra care.

`\twocolumn` of LaTeX works in another way: it builds the columns one after another. A column is a page for TeX, and the finished columns are put side by side when the last one is done. So `figure` and `table`, footnotes, `\marginpar` and such packages work in it as on a page.

The ncolumn package makes the output routine of `\twocolumn` work for three, four or more columns, and adds two things:

- *Spanning material.* Floats, headings and boxes can span k columns from one of the four corners of the page.
- *Footnotes.* The footnotes of a page are put into each column, into the last column, or into an area of M columns across the page.

With two columns and without the new keys, the pages are those of `\twocolumn`. Section 3 shows two pages that are typeset with the package.

Supported formats/engines pdfLaTeX, XeLaTeX, LuaLaTeX (with or without LuaTeX-ja), pLaTeX and upLaTeX (with dvipdfmx); horizontal (yoko) and vertical (tate) writing. The package requires LaTeX 2025-06-01 or later.

2 Usage

```
\documentclass{article}
\usepackage[columns=3]{ncolumn}
```

`columns=`$\langle N \rangle$ sets the whole document in $\langle N \rangle$ columns. If the package is loaded without `columns` in a document whose class has the option `twocolumn`, the document has two columns as before.

2.1 Changing the number of columns

```
\ncolumn{4}
\ncolumn{3}[\section{A heading across all columns}]
\onecolumn
\twocolumn
```

`\ncolumn{`$\langle N \rangle$`}` starts a new page with $\langle N \rangle$ columns. The material in its optional argument is put across all columns at the top of this page, as with `\twocolumn`. `\twocolumn` does not mean "two columns" but "the columns of this document": it goes back to the number of columns that was used before. The classes call it after `\maketitle` or an index to go back to the columns.

2.2 Spanning floats

```
\begin{figure*}[t]               % all columns, at the top
\begin{figure*}[b]               % all columns, at the bottom
\begin{figure*}[span=2,at=tl]    % two columns from the first one, top
\begin{figure*}[span=2,at=br]    % two columns up to the last one, bottom
\begin{figure*}[!,span=2,at=tr]  % ! as for ordinary floats
```

An argument of `figure*` or `table*` with a `=` is read as a list of keys. `span` is the number of columns and `at` is the corner: `tl`, `tr`, `bl` or `br`. `[b]`, which LaTeX does not allow for these floats, puts a float across all columns at the bottom.

The corner is given in the directions of the text: `t` and `b` are the top and the bottom of a column, `l` and `r` are the side of the first and of the last column. In yoko this is what it looks like. In tate the first column is the upper one and the top of a column is on the right, so `tl` is the upper right corner of the page.

The starred floats of other packages take the same arguments, as they are made with the same macro of LaTeX (`\@dblfloat`) as `figure*` and `table*`. `algorithm*` of the algorithmlite package is tested.

A page can have several pieces of spanning material. A piece is put on a page only if the columns it covers have the same height reserved so far; otherwise it would leave a hole, and it goes to the next page.

As in LaTeX, a spanning float is put on a later page than the one where it is met. With the key `same-page-spans`, it is put on the page where it is met

- at the top, if none of the columns it covers is begun;
- at the bottom, if it covers only the current column and columns after it, and the current column has room.

No spanning float is put at the top of a page that begins with the material of `\ncolumn{`$\langle N \rangle$`}[...]` or with a `\spanblock` at the top, as with `\twocolumn[...]` in LaTeX.

In one column, `span` and `at` are ignored and the float is an ordinary one.

2.3 Spanning blocks

```
\spanblock[span=3,at=tl]{\section{A large heading}}
\spanblock*[span=2,at=br]{...}
```

`\spanblock` puts material that is not a float, such as a heading or a tcolorbox, across columns. Without the star it starts a new page and puts the block on it; with the star the block is put on a later page, like a float.

2.4 Footnotes

```
\usepackage[columns=3,footnotes=last-column]{ncolumn}
\ncolumnsetup{footnotes=span,footnote-columns=2}
```

The key `footnotes` has one of these values:

`column` The footnotes are put at the bottom of the column of their marks, as in LaTeX (default).

`last-column` All footnotes of a page are put at the bottom of its last column, as ftnright does for two columns. One run is enough.

`span` The footnotes are put into an area across all columns at the bottom of the page. With `footnote-columns=`$\langle M \rangle$, this area has $\langle M \rangle$ columns. Several runs are needed.

With `span`, the columns that are finished cannot be made shorter for a footnote of a later column. So the height of the footnote area of each page is written to the `.aux` file and is taken off all columns in the next run. The package warns to run again when a height has changed.

Reserving the room can move the line of the mark to the next page, and not reserving it brings it back. If the package finds this, it keeps the room reserved (the page is then shorter by a footnote area that it does not have). Up to about five runs can be needed. `footnote-reserve=`⟨*length*⟩ reserves a fixed height on every page and does not use the `.aux` file.

`footnotes` can differ from page to page: give it to `\ncolumnsetup` right after `\ncolumn{`⟨N⟩`}`, which starts a new page (section 3 does this).

In tate with jlreq, `last-column` is the default, as jlreq puts the footnotes at the bottom of the last column.

2.5 Marginal notes

With three or more columns, a `\marginpar` goes to the nearer margin: to the margin on the side of the first column from the first half of the columns, to the other margin from the second half. The notes of columns that share a margin do not overlap.

2.6 tcolorbox

A tcolorbox with `breakable` is broken across columns as it is across pages. Two packages for tcolorbox are tested with ncolumn:

- tcbpagefootnote (v1.4 or later): with the key `page footnote`, the footnotes of a box are footnotes of the text. `footnotes` puts them as it puts the others, for each part of a box that is broken across columns, and in a tagged PDF too.
- tcbnestbreak (v0.2): breakable boxes inside a breakable box are broken across columns as well.

A box in spanning material cannot have footnotes of the text (see section 5).

2.7 Options and parameters

`columns=`⟨N⟩	the number of columns of the document (`\usepackage` only)
`footnotes=`⟨*value*⟩	where the footnotes are put: `column`, `last-column` or `span`
`footnote-columns=`⟨M⟩	the columns of the footnote area with `span`
`footnote-reserve=`⟨*length*⟩	a fixed height of the footnote area with `span`
`same-page-spans`	put spanning floats on the page where they are met, if possible

The keys are given to `\usepackage` or, but `columns`, to `\ncolumnsetup`.

The parameters of LaTeX for two columns are used as they are: `\columnsep`, `\columnseprule`, `dbltopnumber`, `\dbltopfraction`, `\dblfloatsep`, `\dbltextfloatsep` and `\dblfigrule`. For spanning material at the bottom, there are the counter `dblbotnumber` (default 2) and `\dblbotfraction` (default 0.5).

3 Examples

The next three pages are typeset with `same-page-spans` and with a rule between the columns (`\columnseprule`).

- The first page has three columns. Figure 1 is an ordinary `figure` with `[t]`. Figure 2 is a `figure*` with `[span=2,at=tr]` and Figure 3 one with `[span=2,at=bl]`; both are given at the beginning of the first column. The footnotes are at the bottom of their columns (`footnotes=column`).
- The second page has four columns. The text with the frame is a `\spanblock*` with `[span=2,at=tr]` and Figure 4 is a `figure*` with `[b]`; both are given at the beginning of the first column. All footnotes of the page are in its last column (`footnotes=last-column`).
- The third page has two columns. All footnotes of the page are below the two columns, in one column that is as wide as the page (`footnotes=span`; `footnote-columns=1` is the default).

`figure` with `[t]`

Figure 1: A float of one column

`[span=2,at=tr]`: two columns up to the last one, at the top

Figure 2: Two columns from the top right corner

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4 How it works

1. *N columns.* `\@outputdblcol` keeps the finished columns in N boxes instead of one. `\if@twocolumn` stays true and `\if@firstcolumn` is true in the first column only, so code that tests them works as before.

2. *Spanning material.* Each column has a height that is reserved at its top and one at its bottom, and the height of the column (`\@colht`) is set for each column. The spanning material is laid over the columns when the page is put together.

3. *Footnotes.* `\@makecol` and `\@outputpage` are not redefined: pLaTeX has its own versions for tate, LuaTeX-ja uses their hooks, and so does the tagging code of LaTeX (`\DocumentMetadata`). The package takes `\box\footins` at the beginning of `\output` instead.

4. *Marks.* The code of `ltmarks` that updates the marks for two columns is replaced by one for N columns (the marks of each column are also in the regions `mcol-1`, `mcol-2`, ...). This is the only place where internal variables of another module are used.

The internal macros of LaTeX that are redefined or wrapped are listed at the top of `ncolumn.sty`.

5 Limitations

- Material spans columns from the corners of the page only. It cannot be put in the middle of a page with text above and below it: the columns would have to be balanced for that. The columns of the last page are not balanced either.
- When the floats are put out by `\clearpage`, a float that spans some of the columns is not put into its corner but on a float page, at the side of the first or of the last column.
- With `footnotes=span`, a footnote is not split across pages.
- A footnote inside spanning material is not typeset, as in an ordinary float or in `\twocolumn[...]`. Put `\footnotemark` into the material and `\footnotetext` after it.
- In tate with jlreq, `footnotes=column` and `footnotes=span` do not work with the code of jlreq for its notes, which is written for two columns. Use `last-column`.
- These packages redefine the same macros; loading one of them with ncolumn is an error: ftnright, nidanfloat, dblfloatfix, cuted, balance, flushend, pbalance, flowfram, dblfnote. stfloats gives a warning only, as jlreq loads it with LuaLaTeX; ncolumn replaces its placement of the spanning floats.

6 Tests

`make test` compiles the test files `test-*.tex` with pdfLaTeX, XeLaTeX, LuaLaTeX, pLaTeX and upLaTeX. For each page that is shipped out, `test-common.tex` records the state of the package: the heights that are reserved at the top and at the bottom of each column, the spanning material, and the first and the last mark of each column. At `\end{document}` it compares this with the state that the test file expects, reads the `.aux` file back and checks that every footnote text is on the page of its mark, and writes `NCOL-RESULT OK` or `NCOL-RESULT NG` to the log.

`test-twocolumn.tex` is compiled with and without the package: with two columns, every page is the same, pixel by pixel, as with `\twocolumn` of the LaTeX kernel. `test-tcbpagefootnote.tex` and `test-tcbnestbreak.tex` also check that every footnote text has the width of the footnotes of the page and that no footnote is split or held over. `test-algorithmlite.tex` checks a float of another package, the algorithms of algorithmlite: each of them has to be as wide as the columns it spans. `test-text.tex`, `test-japanese.tex` (yoko and tate) and `test-tcolorbox.tex` are documents with real text that are also meant to be looked at. See `README.md` for the list of the tests.

7 History

v0.1 (2026/11/23) First version.

v0.2 (2026/11/24) `footnotes` and `footnote-reserve` given to `\ncolumnsetup` in the first column of a page, e.g. right after `\ncolumn`, now act on that page: the height of its footnote area was not reserved. Tested with tcbpagefootnote and tcbnestbreak.

v0.3 (2026/11/24) The material of `\twocolumn[...]`, `\ncolumn{`$\langle N \rangle$`}[...]` or `\spanblock` at the top of a page was put too low if it was lower than `\dbltextfloatsep`, e.g. a single line. Tested with algorithmlite, as an example of the starred floats of other packages.

8 License

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